

**THE HISTORY, ECOLOGY AND HABITS OF *THECLA BETULAE* L.
(LEP.: LYCAENIDAE) IN WORCESTERSHIRE**

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ALMOST all accounts of *Thecla betulae* L., the Brown Hairstreak, note the elusive nature of the species, and many entomologists have limited experience of its ecology and habits. This article presents the results of 20 years study of a colony of the species in a local area of Worcestershire which appears to have been isolated for many years, and as this is one of the most northerly remaining in the United Kingdom it probably exhibits more clearly the conditions of importance for viability. Related to the environmental conditions of the area, other now rare or UK-extinct species have occurred, and for general interest references to them have been included.

The principal area is the low lying country bounded approximately by a line joining Worcester — Droitwich — Redditch — Evesham — Pershore — Worcester. This contains a number of old mainly deciduous woods, and many of these have been little disturbed for many years, indeed some of them were managed by slow coppicing up to the 1950s, and several are still only used for shooting. The countryside is very rural with a low population and with the exception of the southern part, much of the land is poor agriculturally.

Thecla betulae L. has always been regarded as a rare species in Worcestershire. As far back as 1834, Dr Charles Hastings (Hastings, 1834) listed it under the heading *Rarer Lepidopterous Insects*, but only one location was mentioned in his book; that was Trench Woods, and an interesting footnote reads “*These woods, situated on an eminence near the junction of the red marl and the lias, about five miles on the east side of Worcester, are much resorted to by entomologists for the rare insects that are met with there*”. These rarities also included (sic) “*P. Asis*, Mazarine Blue; *P. Argus*, Silver Studded Blue; *P. Alsus*, Small Blue; *Nemerobius lucina*, Duke of Burgundy Fritillary; *Sesia Fuciformis*, Narrow-bordered Bee Hawk and *Melitaea Artemis*, Greasy Fritillary.” Alas of these only the latter, now known as the Marsh Fritillary of course, probably still survives (Green, 1985). As for *betulae*, personally I have never found the adult or ova in those woods, although on two occasions I did find a few ova in nearby woods. Other notable species in those early days listed under “*Woods near Worcester*”, were “*V. polychloros*, Large Tortoiseshell and *Pieris Crataegi*, Black-veined White”. It is interesting that Dr Hastings listed all the hairstreaks as butterflies of Worcestershire, including “*T. Pruni*, Dark Hairstreak. Rare”, and “*T.W-Album*, Black Hairstreak”, but in view of the uncertainty about nomenclature at that time (Thomas,

*Jack Green completed this paper just before his untimely death in April 1990.

1989) there must be some doubt as to whether *Strymonidia pruni* L. as known today was really present. Rev Horton (Horton, 1890) referred to "*T. pruni*, Black Hairstreak" in the Malvern district in 1870, and the 1901 Victoria History merely said "Very rare", without locations. I can now reveal that an old local collection was discovered by Mr Richard Parsons in the Greater Wyre Forest area in 1985. It had been amassed by a Mr H. Whitelegg, and contained a single *Strymonidia pruni* L. labelled "June 1946, Ribbesford, Bewdley". No reason has been found for doubting that it was a genuine local specimen and some activity is proceeding in the remote hope that this species might conceivably survive in Worcestershire today.

From the 19th century there were specimens of *betulae* in Worcester Museum labelled "Trench Wood 1856", and the Rothschild collection in the British Museum contains specimens labelled "Persnore 1891". In 1857 Stainton referred to "hedgerows near Worcester", and Tutt said "near Worcester" quoting Edmunds. Earlier Dr Hastings had referred to the superior cabinet of Mr A. Edmunds which contained all the species referred to in his list and, "indeed nearly all the Worcestershire Lepidoptera". This cabinet has never been found, but it was said to contain even one *L. dispar*, Large Copper! In 1870, the Rev Horton (Horton, *loc. cit.*) late Chaplain to the Powick Lunatic Asylum had described *betulae* as scarce but only mentioned Trench Wood. Then in 1899 Edwards and Towndrow (Edwards, 1899) listed Eastnor, Birchwood and Cowleigh in the Malvern area. Finally, the Victoria History of the County of Worcester, 1901 gave Cowleigh and Wyre Forest.

I remained mystified by the lack of any evidence of *betulae* in the county after 1904. Neither the excellent cabinets at Malvern College, nor the 1934 Walter Saunders collection contained any specimens from Worcestershire. So I began to make enquiries with local lepidopterists; Mr Fred Fincher, the doyen of Worcestershire naturalists, Mr A. Harthan of Sheriffs Lench who had the last sightings of *A. crataegi* at Craycombe Hill in 1923 and probably the last *Carterocephalus palaemon* Pallas at the same place in 1952 (Green, 1982); Mr L. Bawden of Evesham who was extremely knowledgeable and for example knew where *N. polychrolos* bred until 1959 in woods to the south of Evesham.

Further afield there was Dr R.H. Clarke who had lived in the county for a number of years before moving to Stanton St John to commence his work on *Apatura iris* L.; and members of the Birmingham Natural History Society. Surprisingly no one had any new knowledge of *betulae* in Worcestershire, although Leslie Evans of the Birmingham NHS knew of one location for it at that time in Warwickshire at Austy Wood. Then Dr Michael Harper of Ledbury suggested that it might be worth contacting Mr Geoffrey A. Cole who had been chief administrator for Worcester hospitals in the 1940s, and by then retired to Slapton Ley in Devon. This

enquiry provided the vital clue, because it transpired that he had found *betulae* to the east of Worcester in 1945/6. He was able to recall a particular wood where he had beaten larvae in 1946 to breed a series. Mr Cole also wrote of *Endromis versicolora* L. at Button Oak in Wyre Forest (now believed extinct there), of outings to the Cotswolds for *Maculinea arion* L., and of finding *Photedes fluxa* Hb. abundant at Trench Wood. Those were the days!

The search now began in earnest for *betulae*, but a further three years were to elapse before the first ovum was found in April 1970. The wood identified by Mr Cole was very thoroughly searched, also Trench Wood, but without success. A friend from Pershore, Mr Lionel Eden, became interested and joined in some of the searches, and his detailed local knowledge was most helpful, indeed he spotted the first egg. We had progressively extended the search area from the wood identified by Mr Cole, obtaining permission to search privately owned woods. One event I shall always remember was a challenge by an irate gamekeeper with shotgun pointed menacingly. My explanation that I was looking for butterfly eggs in February must have sounded ludicrous! It turned out that the owner had not advised him about my agreed visit. A pint in the local pub and a belated message from the owner made him a valued contact, moreover information from him led to the later discovery of another location for *betulae*. Gamekeepers can be very useful!

Through the 1970s the distribution of the species was slowly established by finding the ova. Searches elsewhere in the county, such as in the Malvern area and in Wyre Forest proved negative. I was given some useful advice by Dr Jeremy Thomas and Dr T.W.C. Tolman. The latter was studying the UK distribution, regional variations and the relationships with climatic conditions, and in particular he emphasised the requirements for a large wood to serve the function of a last retreat in adverse years. He also suggested more searches along streams having nearby blackthorn, especially if near to deciduous woods. From 1978, because of insufficient time to complete ova counts over the increasing known range of the colony, I decided to concentrate on exploring further afield. First I made surveys to identify possible places, then I carried out thorough searches in small sample areas. Although a few new places were discovered, the overall success rate was low, and it became clear that the females were extremely selective about where they flew and where they laid. No ova have been found above an altitude of 250 ft ASL. All the time though I was developing a sixth sense of understanding this elusive and fascinating species.

Eggs have only been found in three basic types of habitat. First on bushes in the age band 3 - 9 years which are growing in very sheltered locations a short distance out from the edge of a deciduous wood in which oak is the predominant tree. Such bushes are nearly always sucker growths

from blackthorn thickets, and they are especially favoured if they are stunted because of nibbling by sheep, in which case they will also have strands of wool. Secondly, in hedgerows extending from such woods, and again any outlying young sucker blackthorns are preferred; however, importantly in this type of habitat, when the hedges are cut low, eggs are also laid in the forks of new spines on old wood. Thirdly, on waste ground not far from a wood where there are plenty of spaced bushes, usually a mixture of hawthorn and blackthorn, e.g. a perimeter dispersal point on a disused airfield.

Situations which have provided acceptable sheltered conditions are:

- (1) slopes down to the edge of a wood
- (2) small fields with tall hedges
- (3) southerly-facing hedges fronted with ditches in which blackthorn suckers are growing and
- (4) bridle tracks on or near to the perimeter of a wood which are oriented to have afternoon sunshine.

The eggs are laid mostly in forks at the base of short spines where the diameter is typically 2 - 3 mm. However, they are occasionally found on thicker main stems, and not always in a fork. The median height of eggs above ground level is about 24 inches; the distribution is skew, the lowest I have found was only two inches above the ground, the highest about 6ft. The majority are typically in the range 9 - 40 inches. Eggs are usually laid singly, occasionally a pair together, and sometimes even more. If one egg is found, it is well worth a thorough local search because a female is likely to have spent some time crawling in the vicinity. The search should extend below the height of summer grass because the butterflies may have crawled to low levels where they presumably find extra shelter, and with sunshine might have been induced to lay. The influence of wind on the height at which the ova are laid has not been studied, but it may be significant that in a low count in April 1990, Mr Endacott and Mr John Denning observed that more were at a higher level of 4 - 5 ft, and on lower bushes they tended to be in local clusters. Indeed, ova are only laid in very local areas and these will tend to change over the years as previously favoured blackthorn becomes too old. Once bushes begin to bear sloes, or if any noticeable amount of lichen develops on them, it is extremely unlikely that they will be used. In managed areas, most of these blackthorns will be removed in order to generate new growth, some will be left to grow on and produce thickets and shelter. The essential requirement for sunny but sheltered habitats cannot be over-emphasised. If new growths are vigorous and develop into tall single main stems with widely spaced long spines having a greyish appearance they are seldom used, it is better to prune them back and develop stockier bushes. Presumably the tall stems are more exposed to wind and are less attractive.

Searching for ova required considerable patience and perseverance. The weather needs to be calm, dry and not too cold, and without frost during

the previous night. It helps if there have been a few days without rain, so that conditions underfoot are tolerable, especially on impervious clay. Eye fatigue can be a problem, and I have found that 20 minute searches with five minutes rests is a practical schedule. A 2½ inch reading glass is a valuable aid for scanning the bushes, a small mirror mounted on a rod for inspecting under branches, and a watchmaker's glass for confirming identification. The latter is very necessary because bird droppings can be misleading. Another regular occurrence in typical fork locations is a pair of elongated white ova which are not *betulae* ova. It is normally mid November before leaf fall is sufficiently complete to permit a thorough search, and after 20th April leaf break causes difficulties. The date for commencement of hatching depends on the severity of the winter, the temperatures in April and the start of leaf break; in an average year I consider that date is about 20th April and the majority hatch during the period 24th April to 5th May. The winters and early springs of 1986, '87, '88 and '90 contrasted markedly and permitted observation of the variations in hatching on account of the climatic factor. The winter of 1986 was very cold, and in Worcestershire the mean temperature in February was 5°C below normal, the coldest since 1947, March continued cold and April was the coldest since 1922; I found that only a few per cent of eggs had hatched by 26th April. In marked contrast the winter of 1988 was exceptionally mild and sunny, March and April continued mild and by 19th April approximately 30% of the eggs had already hatched. The winter and spring of 1990 were even more exceptionally warm and sunny and approximately 40% of the observed ova had hatched or were hatching by 13th April. 1987 was very cold in January and March, but April was the warmest since 1911 with a remarkable hot dry sunny spell commencing on the 13th; a search on 22nd April showed that about 10% of the eggs had hatched, and those were mainly on bushes in particularly warm sunny positions.

Occasionally in late April one finds an ovum where the larva has started to nibble the small hole in the crown through which it will emerge. The shiny black head shows up well as it moves round slowly enlarging the hole, and it is interesting to observe progress with a watchmaker's glass. Eventually it emerges quite quickly and moves directly to the nearest bud, typically not more than an inch away. The body is then almost colourless, hairy and with a slight greyish tint. The larva crawls up the side of the bud and then disappears between a slightly opened outer leaf and the unopened centre; there it commences to eat and bore into the bud, turning to a green colour as it does so.

Having located the favoured areas for ovipositing, these offer the best prospects of seeing the adults and over 20 years enough observations have been made from which tentative conclusions about their habits can be drawn. Typically, given a good day, it is not worth starting searches until 11 am BST and I consider that a minimum shade temperature of 18°C with

sunshine and little or no wind are required before there is any sign of adult activity. The best prospects are during the next 2½ hours, and around 4 pm is the time to be on the look-out for females on leisurely return flights to the wood, sometimes 10 - 30 ft above the ground. Unless it is an exceptionally warm sunny day, 4.30 pm marks the end of the day's activities. Typical wingspans of Worcestershire adults are male 37mm and female 41mm.

I am not sure when they first begin to emerge. Dr Thomas (Thomas, 1989) considered that this was "from late July to mid-August depending on May to July temperatures" and added that ". . . the butterflies are seldom seen for the first two weeks . . ." The earliest date I know of was 5th August, when by chance a crippled female was spotted near the ground. In a year of typical average climatic conditions, 20th August appears to be the first practical date to possibly see an adult flying and 25th August for a good chance. The best prospects are during the first ten days of September, and the last worn adults may be encountered in the first week of October. (Even as late as 12th in 1980.) Figure 1 shows daily maximum and minimum temperatures from 1st August to early October in 1987 when overall weather conditions were near to long term averages during the flight season. Bearing in mind that maximum daily temperatures are only reached for a short time, there is a marked limitation on account of the temperature and sunshine factors when flying might take place, and on any day there is a limited period when the threshold temperature is exceeded, this tending to decrease as the days shorten.

Males are rarely seen low down, where the overwhelming majority are females. There is a better prospect of seeing a male by using high power binoculars to search amongst the upper branches of oak and ash trees which are in an especially sheltered location with a plentiful supply of aphid honeydew. Dr Thomas has contended that adults congregate on "master trees", and that three examples he knows of in the UK are large ashes towering above the surrounding canopy (Thomas, *loc. cit.*). I have located a few trees which give support to the master tree concept, but they are oaks, and the congregations are not necessarily on the highest branches. A typical location can be defined by a high stand of old blackthorn on the south facing edge of a wood with taller oak trees behind, and the particular branch will be positioned in a kind of natural recess amongst surrounding branches. It is the type of location where *Quercasia quercus* L. will congregate, and the occasional *Ladoga camilla* L. might be seen earlier in July, and in Buckinghamshire one might find *S. pruni* L. I now use 16 x 50mm binoculars preferably with a steady support, which are necessary in order to be sure about identification, because *quercus* is common in the area and may be encountered well into September — I once saw one as late as 23rd in 1972. A telescope could be used to give higher magnification at the expense of a reduced field of view.

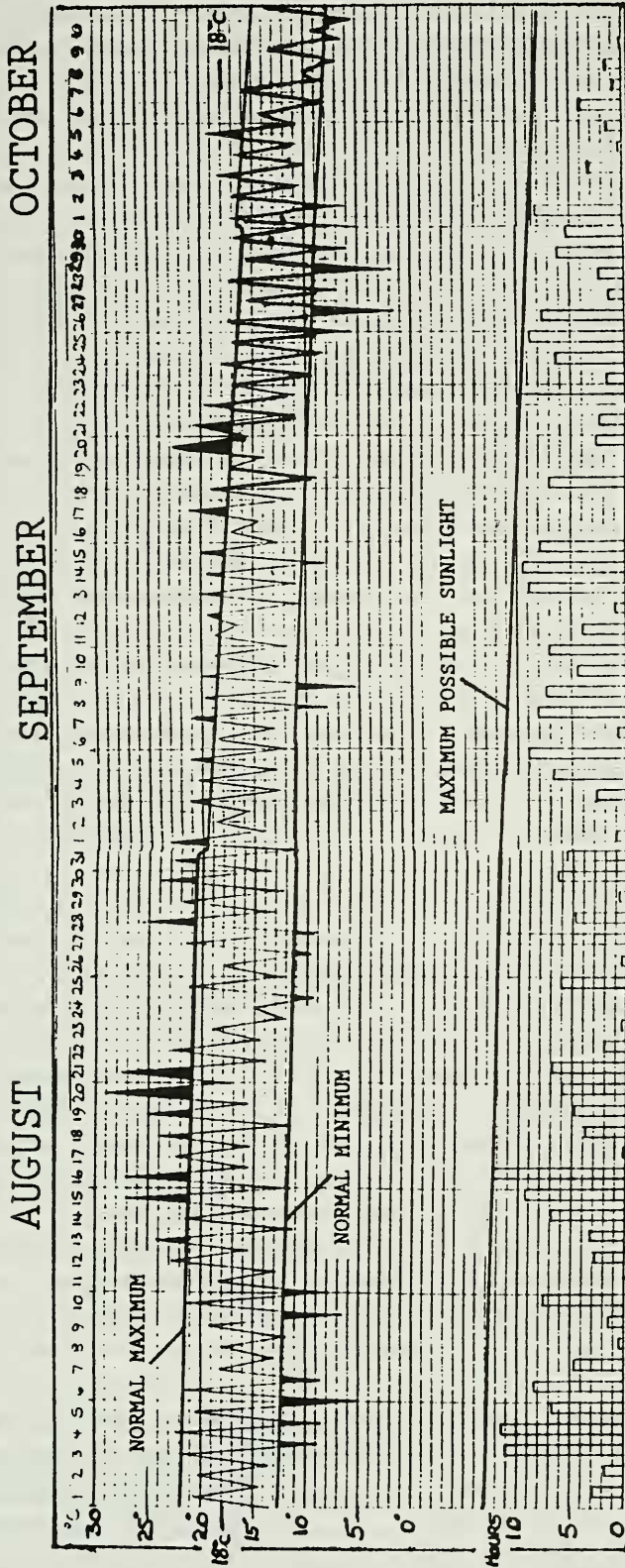


Fig. 1. Diurnal temperatures and sunshine during the adult season of *Thecla betulae* L. in Worcestershire, 1987 (weather near long term average).

Searches for non-flying adults in the trees can start from about 10th August, the initial sighting will usually be one basking in the morning sunshine. If crawling, any sighting is likely to be transient and frustrating because of the foliage. I suspect that several may be present when one is seen. Identification of favoured trees in a large area is difficult, but working from ova density distribution charts, the search areas can be narrowed down. It is a very time-consuming procedure, but does offer the prospect of seeing the elusive males. At ground level I did once find one feeding on fleabane about 25 yards from the edge of a wood, and last year on 15th August I had the novel experience of intercepting one flying in purposeful manner about 2 ft above the ground in the middle of a fairly large field, going in a northerly direction towards a small area which is regularly good for ova. I wondered whether it was responding to some signal from a freshly emerged female. No one seems to have explained how adults emerging over a large area manage to congregate together, or is it only happening in small groups? There is plenty of scope for research, perhaps even with some kind of monitoring by tagging individuals with novel microelectric devices? There is much more to be discovered about the life and habits of *betulae*.

Released bred specimens invariably fly upwards to the high tree tops and a few observations of freshly emerged wild adults indicates the same behaviour. Consider the case of an eventual adult from an egg laid in a hedgerow at a considerable distance from a wood. Suppose it is a female. The chances of finding a mate in the nearest tree will depend on the distance from the wood, as the density of eggs declines with distance. In a good year it could be lucky and find a mate, and in due course it could fly either nearer to or further from the "headquarters" wood. If habitat conditions were still favourable in the outward direction, then the range of the colony would tend to increase and perhaps reach and colonise another wood. If the female did not find a mate it would presumably fly to other trees, and might eventually get back to the "headquarters" wood. Thus the colony will tend to expand or contract with good or bad years. Destruction or severe cutting of long lengths of hedgerows on a route that has been used by successive generations seems to stop use of that route, moreover ploughing of an adjacent field is likely to lead to the same result. Repeated severe machine cutting of hedges and changes of land use from livestock to cereals is leading to fragmentation of the *betulae* colony in Worcestershire. In the past, despite the absence of records, the species must surely have been well established over a much wider area before the progressive destruction and damage of the undisturbed countryside by mechanisation and by use of chemicals in agriculture.

Turning to the habits of females, relatively speaking these are much easier to find once they begin their ovipositing flights from late August. In the first hour of morning activity it is always worth pausing to scan any large patches of bramble in the hope of very occasionally seeing one on a late flower or possibly on a ripe berry, just as in the case of *Strymonidia*

W-album L. They descend from their high overnight roosts to the blackthorn thickets and bushes, and spend the great majority of their active time simply crawling slowly along the branches, twisting and turning, often with abdomen bent downwards, but the ovipositing rate is slow. I once watched a female for 40 minutes before it deposited the first egg, although for most of that time the abdomen was positioned to do so. When they do fly it is often to a new location at least several yards away, after which the crawling routine will recommence. Sometimes a search of an outlying small bush will reveal a female, and they are easily approached for photographs. Another technique is to be on the look-out for one having a periodic rest on a hedgerow, where they like to bask with wings open. My wife has an uncanny knack of spotting such females. I do better scanning a length of hedgerow from some distance out using the high power binoculars — this in known ovipositing areas. For longer outward flights, they fly quickly in a characteristic manner, often quite high up. However, the actual time in flight is a very small part of their activity, explaining why they are so seldom seen by casual observers.

I have made an interesting discovery that in September a field maple tree in a tall hedge appears to serve as a staging post for females on outward flights. They arrive at a height of about 15 ft having flown 50 - 80 yards across a field on a slowly descending flight path from the tree tops of the wood. The maple leaves are turning golden brown and offer good camouflage plus honeydew. I have seen as many as five females at a time in this tree, some staying for 20 minutes before moving off individually in either direction along the top of the hedge to reach favoured ovipositing areas.

Table 1 shows sample data first used when seeking correlations between ova counts and the climatic factors throughout the life cycle. The climatic data was taken from recording stations in the Pershore area, the nearest to a particular part of the colony where, with the exception of 1976, I had comparable counts from 1970 to 1982, and where there had been a continuity of suitable habitat. The possibility of a significant local variation on account of a microclimate factor is considered small. The ova count basis was consistent, two people searching for two hours in a defined area; independent counts were carried out on occasions to verify that the same or very near same score was obtained. Comparison checks between late autumn and April showed no loss of ova. Total ova counts for the whole colony were much higher, at least several hundred in good years, but records were insufficiently complete to permit statistical analyses over a long period. Another problem was habitat destruction in some areas through agricultural practices, indeed records for the area covered by Table 1 were invalidated for that reason after 1982. These analyses produced a significant correlation between ova count in a season and the lowest monthly mean minimum temperature during the previous winter.

Simple statistical analyses were applied to the data in Table 1 because the ova counts were in general so low, and a ranking method determining

Table 1. Ova Counts vs Climatic Conditions 1969 - 1982

Climatic Factor	Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	Possible effect on Populations
Winter severity Mean min temp °C Previous December January February	1.5	1.4	2.3	4.7	3.1	2.9	6.3	3.0	-0.3	4.2	1.9	3.4	3.5	-2.9	1. Ova condition in spring 2. Reduction of predators Early development of larvae	
	3.7	1.7	2.3	1.6	2.5	3.6	4.5	3.6	0	1.0	-3.4	-0.6	2.4	-0.5		
	-1.4	0.6	1.5	2.6	1.4	2.8	1.7	2.0	2.9	0.2	-3.4	3.3	0.1	2.6		
Late spring warmth Mean daily temp °C May	11.9	13.7	11.6	10.6	11.8	11.0	10.2	12.2	10.4	12.1	10.4	11.7	11.7	12.3	1. Adult emergence 2. Mating 3. Adult food supply Ovipositing rates	
	21.1	20.8	20.5	20.3	22.2	20.5	25.0	24.2	19.6	19.8	19.7	20.8	22.5	20.5		
Mean daily sunshine hours September warmth and sunshine Mean max temp °C Mean daily sunshine hours Annual sunshine total hours	4.69	5.45	4.30	5.22	5.74	5.92	7.06	7.91	5.10	4.22	5.49	4.85	6.50	4.67		
	17.9	19.4	19.8	16.4	19.6	16.1	18.3	17.4	17.4	18.9	18.3	19.0	19.4	19.1		
	3.05	4.85	5.95	3.90	4.93	4.65	4.91	3.35	3.76	5.57	5.34	5.01	5.50	4.59		
Ova count in 4 man-hours	15.15	15.37	14.82	12.92	15.73	14.89	16.13	15.62	14.64	14.05	14.45	14.37	13.06	13.80		
	30+	16	1	7	0	6	No check	0	5	11	27	7	27	35		
Year — spring	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983		

NB: Long period averages at Pershore* Sunshine 1460 hours, Rainfall 644.1mm.

Spearman's Rank Correlation Coefficient showed the high correlation between ova count and previous winter severity, Student's t was 4.078 for 11 degrees of freedom and χ^2 was 20.67. (P) was very slightly above the 5% level. The same approach for Table 2, with much higher ova counts showed even higher probability. Analyses then continued in a search for a second order variation on account of temperature and sunshine during the summer months, as proposed by others (Thomas, 1989 and Archer-Lock, 1979).

Table 2 shows data for the period 1985 - 1990 for another area of the colony where ova counts are much higher, and again the correlation between ova counts and previous winter severity is clear. A logical explanation is that losses to predators during subsequent phases of the life cycle are reduced because their numbers are much less after a hard winter; also ova will be in a better condition for hatching in late April and adult population should be higher with potential for laying more ova in late August and September, subject of course to any second order influence on account of other climatic factors during spring and summer. The adverse effect of severe winters on bird populations is well-known, and Dr Thomas noted from his research work on a Surrey colony that the highest percentage loss in a life stage occurred during the pupal stage through shrews, mice and carabids, accounting for about two-thirds of pupae; the importance of losses in the pupal stage was first proposed by Dr Tolman (Tolman, pers. comm.), who also noted the probable connection with the marked reduction in numbers of avian predators (especially owls) on voles and mice.

Table 2. Ova Counts vs winter severity 1985-1990

Monthly Mean Min Temp °C	Year						
	1985	1986	1987	1988	1989	1990	
Previous December	3.2	5.3	4.7	3.8	6.6	3.5	
January	-0.8	2.0	-1.1	4.0	4.1	5.1	
February	-0.8	-2.8	1.9	2.8	3.7	4.95	
Ova Count in following spring	35	93	50+	27	30	?	
	1986	1987	1988	1989	1990	1991	

It is appreciated that use of the available calendar monthly data could mask a very cold mid-month to mid-month period, with compensating warmer temperatures during the other two half months. However, other bases for indicating winter severity yield similar conclusions that there is a correlation with subsequent ova counts, although not as high as when the calendar mean minimum temperature statistic is used, e.g. winters of 1979

and 1982. If this hypothesis is correct the present 1990 third consecutive warm winter in Worcestershire must be viewed with some concern for *betulae*. The UK distribution of the species suggests that overall higher annual temperatures such as in South Devon, are important and result in much higher populations (Archer-Lock, pers. comm and 1979). In Devon and in West Wales rainfall is much higher than in Worcestershire, and again winter temperatures are higher. Only in the East Midlands do climatic conditions approximate to those in central Worcestershire.

When the first ova were found in 1970, ornithological and botanical interests had already prompted Mr Cecil Lambourne of the Worcestershire Nature Conservation Trust (WNCT) to approach Mr Chris Fuller of the West Midlands Region of the NCC with the proposal that SSSI designation would be appropriate for the area; the discovery of *betulae* accelerated action and by 1971 this had been obtained. In retrospect this was important and the management agreement specifying acceptable farming practices compatible with the breeding cycle of the butterfly made a valuable contribution to subsequent conservation. In 1976 Mr Fuller was succeeded by Mr Noel King who had previously been in the NCC Regional Office which was responsible for parts of Bernwood Forest where both *betulae* and *pruni* were present, and he quickly became interested in the Worcestershire site. When I first took him there he immediately remarked on the close similarity of soil conditions and flora to those in Bernwood Forest. Subsequently he has made excellent contributions to enhance the goodwill and co-operation of landowners and farmers, and later Dr John Birks joined him to further promote those activities, indeed the contribution of NCC could hardly have been better. Management methods have been and continue to be refined and the SSSI area now provides a headquarters for *betulae* where, in terms of habitat requirements, the situation appears well safeguarded. Risks in the foreseeable future appear to rest mainly with possible commercial development of relatively poor agricultural land; large financial organisations have influence and SSSIs are not sacrosanct. The current nationally reported proposed large scale housing development around the village of Hanbury, which is the real life basis for the village of "Ambridge" in the well-known radio programme "The Archers" is an example, and that area has had and may still support a small population of *betulae*. This central area of Worcestershire is close to the M5 and conveniently near to the West Midlands conurbation, so such developments are always a possibility. I have no illusions that the presence of a rare butterfly would have any influence on developers! Another problem has arisen in the last few years with trespassers on the strictly private land. There has, perhaps inevitably, been some leakage of information about the colony, and butterfly enthusiasts do appear. Some unfortunately have undesirable habits such as leaving gates open at critical times for sheep breeding experiments, and this causes extreme annoyance to farmers, conceivably to a point where the presence of *betulae* might be

to farmers, conceivably to a point where the presence of *betulae* might be regarded as undesirable by a farmer. Others take ova if they can find them, although tracks in rough ground quickly show that trespassers have been there. The risk does not lie with the relatively small loss of ova, it is the impact on the essential goodwill of owners and tenant farmers. WNCT have appealed to anyone who has learnt about the site to keep away. In the future it is envisaged that arrangements can be made for those with a genuine interest to see the work that has been done.

SSSI management is directed to ensure that in future years there will always be adequate areas of developing blackthorn in the 3 - 9 year old category in sheltered areas. Some older blackthorn is left to grow on to thickets, from which outlying suckers will appear, often in sufficiently sheltered positions to provide new ovipositing sites, other older thickets are deliberately removed. Tall hedges are periodically lowered in sections, and any longer hedges required to be cut regularly only receive attention in the period late July to mid August, and then often in sections on a two or three year cycle, this to minimise any loss of stock. At the same time careful consideration is always given to the requirements of the farmers; for example one farmer had a typical clause in his tenancy agreement about "delapidation" of land and property, whereby he could be liable for allowing blackthorn to spread to an extent which invoked the clause, thereby incurring a substantial financial penalty! NCC legal branch resolved that problem for him.

The Malvern Sub-Regional office of NCC West Midlands have already financially supported important lepidoptera surveys, and if the predicted "greenhouse effect" of higher temperatures occurs, the counties of Herefordshire, Worcestershire and Gloucestershire which they cover, offer good potential for further research. To date they have sponsored a three year study of *A. adippe* D. & S. on the Malvern Hills, West Worcestershire and Herefordshire Commons, by Matthew Oates, following his work on that species in Cumbria. This has confirmed and refined the dynamic habitat management methods evolved since the 1970s by the Malvern Hills Conservators and we now have in local areas the highest density colonies in the UK. It should be noted that the Conservators have publicly stated that within their legal powers granted by Parliament they will not hesitate to prosecute anyone found taking specimens of this Red Book species on their land. Maintenance support grants have benefitted the SSSI within the *betulae* colony. In the Gloucestershire Cotswolds, Matthew Oates was supported for studies of *H. lucina* L., revealing a very satisfactory situation albeit in many very local colonies, and currently under the enthusiastic direction of Mike Wilkinson assessment of habitats and lycaenidae are proceeding. In Worcestershire given higher temperatures one can envisage research and controlled re-introduction experiments with species such as *S. pruni* and *N. polychloros*, both of which might conceivably still survive; *A.*

crataegi and *C. palaemon* are other possible candidates. We know where *A. iris* L. has bred and can breed in the county and I have sporadic definite records over the last 40 years, but perhaps surprisingly nothing since 1986.

In conclusion on *betulae*, I am reasonably optimistic about future prospects. I regard it as a survivor from the Royal Feckenham Forest of the Middle Ages and probably since the sub-boreal period after the last ice age. It would indeed be a sad day if it finally became extinct through man destroying its habitat after such progress has been made in understanding why it has survived for so long in our isolated Worcestershire colony.

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A Small Tortoiseshell "courting" a Peacock butterfly?

I was most interested to read Mr A.A. Allen's description of the courtship display between a Small Tortoiseshell and a Peacock butterfly (*Ent. Rec.* **102**: 198) as I witnessed a similar event during the spring of 1984 on the edge of a meadow at Middleton, Freshwater, Isle of Wight. In this case the sexes were the same and I wonder whether such a courtship display is governed by a sex-pheromone. This case was described in the *Entomologist's Gazette* **37**: 82.— S.A. KNILL-JONES, Roundstone, 2 School Green Road, Freshwater, Isle of Wight.